PROC. ENTOMOL. SOC. WASH.
81(1), 1979, pp. 51–59

A NEW NEOTROPICAL GENUS OF PREDACEOUS MIDGES, WITH A KEY TO THE GENERA OF HETEROMYIINI (DIPTERA: CERATOPOGONIDAE)

WILLIAM L. GROGAN, JR. AND WILLIS W. WIRTH

(WLG) Department of Entomology, University of Maryland, College Park, Maryland 20742 (now at: Department of Biological Sciences, Salisbury State College, Salisbury, Maryland 21801); and (WWW) Systematic Entomology Laboratory, IIBIII, Agric. Res., Sci. and Educ. Admin., USDA, % U.S. National Museum, Washington, D.C. 20560.

Abstract.—**Physohelea**, a new genus of predaceous midges of the tribe Heteromyiini, is described and illustrated. It includes the type-species, *Neurohelea oedidactyla* Ingram and Macfie, from Argentina, and *N. turgidipes* Ingram and Macfie, from Chile. A key and phylogeny are presented for the Heteromyiini, and phylogenetic relationships within the tribe are discussed.

Ingram and Macfie (1931) described *Neurohelea oedidactyla* and *N. turgidipes* from Patagonia and South Chile, respectively. In their excellent paper they remarked that these two species resembled both *Clinohelea* Kieffer and *Neurohelea* Kieffer in possessing a swollen front fifth tarsomere. They distinguished *Clinohelea* from these two species by: "all femora are slender and unarmed, the costa is not prolonged beyond R5, the median fork is broadly sessile, and on the four posterior legs of the female the fourth tarsal segment is armed, and the claws are very unequal." They concluded that these two species more closely resembled *Neurohelea* because "the only difference to be found is apparently in the femora, all of which in *Neurohelea* are slender and unarmed. We have therefore referred the two speciese described here to this genus, assuming that, as only a single species is known, the armature of the femora may not be in this case a character of generic importance."

We consider the allocation of these two species to *Neurohelea* by Ingram and Macfie at the time a prudent decision. However, since the publication of their paper in 1931, another species of *Neurohelea, N. nigra,* has been described by Wirth (1952). An additional species, *N. macroneura,* originally described by Malloch (1915) in *Johannsenomyia* and later allocated to *Neurohelea* by Johannsen (1943), was apparently unknown to Ingram and Macfie. The type species of *Neurohelea, N. luteitarsis* (Meigen), occurs in the

Palaearctic Region while the above two species are Nearctic. These three species of *Neurohelea* are very similar morphologically with but minor differences at the species level, and it now appears that they comprise a rather well-defined genus, apparently Holarctic in distribution.

Recently, we discovered in the material in the U.S. National Museum a specimen of *Neurohelea turgidipes* collected in Patagonia by R. and E. Shannon in 1926 on the same expedition during which F. and M. Edwards collected the type-series of *N. turgidipes* and *N. oedidactyla*. Unfortunately much of Shannon's collection was not made available for study when the British Museum (Natural History) published its series on the Diptera of Patagonia and South Chile. Through the courtesy of Richard Lane and the trustees of the British Museum (Natural History), we were able to borrow the type-series of *N. oedidactyla* and *N. turgidipes*. The female holotypes of both species were mounted on slides in balsam by Ingram and Macfie and are in excellent condition. After comparing the type-material of *N. oedidactyla* and *N. turgidipes* with other species of *Neurohelea*, we feel it necessary to propose a new genus for them.

In this paper we are also revising the recently published key (Wirth et al., 1974) to the tribe Heteromyiini, to include this new genus and to correct some problems in classification. In addition we are including a section on the phylogenetics of the Heteromyiini to elaborate on our evaluation of characters in this tribe. For an explanation of general terminology of Ceratopogonidae see Wirth (1952) and Wirth et al. (1977). We are grateful to Ethel L. Grogan for preparing the illustrations.

Key to the Genera of Heteromyiini (Females)

1. Media barely sessile, forking at level of r-m crossvein; fourth tarsomere of hind leg cordiform 2
– Media broadly sessile, forking proximal to r-m crossvein; fourth tarsomere of hind leg bifid or greatly elongated, not cordiform 4
2. One radial cell; claws of hind leg without basal inner tooth .... *Neurobezzia* Wirth and Ratanaworabhan
– Two radial cells; claws of hind leg with basal inner tooth 3
3. Front femur bearing 5–12 spines; fifth tarsomere of front leg elongate, greatly inflated; claws moderately small, less than ½ length of fifth tarsomeres ..... *Physohelea*, new genus
– Front femur without spines; fifth tarsomere of front leg shorter than those of middle and hind legs, slightly inflated; claws moderately large, more than ½ of length of fifth tarsomeres .. *Neurohelea* Kieffer
4. Fourth and fifth tarsomeres of hind leg greatly elongated; hind claw greatly elongated 5
– Fourth tarsomere of hind leg bifid, spinose; fifth tarsomere of hind

leg about as long as those of front and middle legs; hind claw not greatly elongated 7

5. Front femur greatly swollen, bearing 20–30 spines; claws of front and middle legs with basal inner tooth ..... *Heteromyia* Say
– Front femur slender with less than five spines; claws of front and middle legs without basal inner tooth 6
6. Inner claw present on hind leg; fourth tarsomere of front and middle legs bifid, spinose; wing fasciate ..... *Tetrabezzia* Kieffer
– Inner claw absent on hind leg; fourth tarsomere of front and middle legs cordiform, without spines; wing hyaline .... *Pellucidomyia* Macfie
7. Claws of front leg unequal; eyes broadly contiguous .... *Metahelea* Edwards
– Claws of front leg equal; eyes broadly separated 8
8. One radial cell; anterior scutal spine strongly developed .... *Ceratobezzia* Kieffer
– Two radial cells; anterior scutal spine poorly developed or absent ..... *Clinohelea* Kieffer

Physohelea Grogan and Wirth, NEW GENUS

Type-species, *Neurohelea oedidactyla* Ingram and Macfie, by present designation.

Diagnosis.—As genus of predaceous midges of the tribe Heteromyiini distinguished from all other ceratopogonid genera by the following combination of characters: Fifth tarsomere of front leg elongate, greatly inflated; front femur slightly swollen and bearing 5–12 spines; wing slightly infuscated, with 2 radial cells, the costa extending beyond R4+5 to 0.87–0.91 of wing length; media barely sessile, forking at level of r-m crossvein; claws moderately small, less than ½ length of 5th tarsomeres, equal in size and possessing basal inner teeth; 4th tarsomeres cordiform. Male unknown.

Physohelea keys to couplet 9, the tribe Heteromyiini, and couplet 36, *Neurohelea* Kieffer, in Wirth et al. (1974) but differs from that genus by several characters. *Neurohelea* has shorter, stouter legs and the front femur lacks spines, the front fifth tarsomere is shorter than the others and just slightly inflated, the claws are much longer, more than ½ the length of the fifth tarsomeres, the costa extends far beyond R4+5 to more than 0.97 of the wing length, and the flagellum is much shorter and stouter. *Heteromyia* Say differs from *Physohelea* in having a greatly swollen fore femur bearing 20–30 spines, fasciate wings with a broadly sessile media, hind fourth and fifth tarsomeres greatly elongated and hind claws greatly elongated. *Neurobezzia* Wirth and Ratanaworabhan, the only other heteromyiine genus with a media forking at the level of the r-m crossvein, differs readily from *Physohelea* in having only a single radial cell. All other genera in the tribe

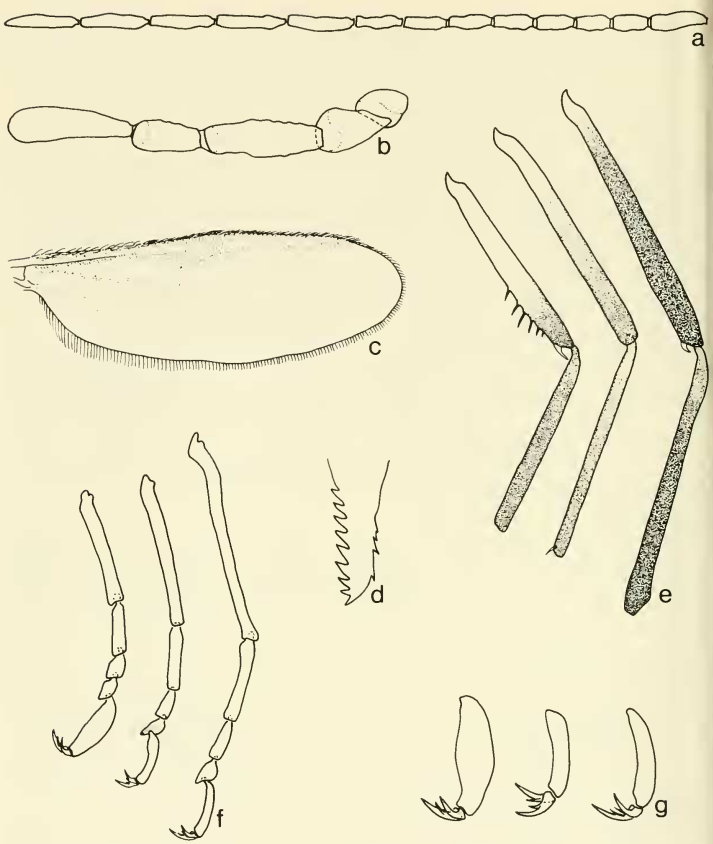

Fig. 1. *Physohelea oedidactyla*, female. a, flagellum; b, palpus; c, wing; d, mandible; e, leg pattern; f, tarsi; g, fifth tarsomeres and claws.

Heteromyiini differ from *Physohelea* in having a broadly sessile media and the hind fourth tarsomeres either greatly elongated or bifid and spinose.

Etymology.—The generic name is a combination of Greek *physo* (inflated) and *heleios* (marsh dweller) and refers to the characteristic inflated front fifth tarsomeres of this genus.

Physohelea oedidactyla (Ingram and Macfie), NEW COMBINATION
Figs. 1, 2a

Neurohelea oedidactyla Ingram and Macfie, 1931:212 (female; Argentina); Wirth, 1974:48 (in catalog of Neotropical Ceratopogonidae).

Diagnosis.—A species of *Physohelea* characterized by its dark brown legs with the proximal ½ of the front and middle femora and base of the hind femur yellowish; scutum brownish.

Female.—For a complete description see Ingram and Macfie (1931). To that description may be added the following: Wing length 2.46 mm; breadth 0.86 mm. Antenna with lengths of flagellomeres (Fig. 1a) in proportion of 19-12-12-13-14-15-15-16-23-23-22-23-25; antennal ratio 1.00. Palpus (Fig. 1b) with lengths of segments in proportion of 7-8-15-9-15; palpal ratio 3.0. Mandible (Fig. 1d) with 8–9 large coarse teeth on inner margin; outer margin with 3–4 small, widely-spaced teeth. Legs (Fig. 1e) with dark brown femora and tibiae except yellowish on proximal ½ of front and middle femora and base of hind femur; front femur with 5–7 spines; tarsi (Fig. 1f) yellowish on proximal 3 tarsomeres, brown on distal 2 tarsomeres; 5th tarsomere of fore leg (Fig. 1g) elongated and greatly inflated, shorter and slender on middle and hind legs; claws small, equal sized, with basal inner teeth. Wing (Fig. 1c) slightly infuscated, surface with microtrichia only; 2 radial cells; costa extending beyond R4+5 to 0.87 of wing length; media barely sessile, forking at the level of r-m crossvein; cubitus forking at level of r-m crossvein. Abdomen with genitalia as in Fig. 2a; 9th sternum with truncate anterior margin; posterior margin cleft; 8th sternum with a pair of bifid arms; 10th sternum with a deeply cleft anterior margin and 6 pairs of large setae. Two or three small, spheroid, subequal spermathecae with narrow, moderately long necks, the largest measuring 0.067 by 0.052 mm.

Male.—Unknown.

Distribution.—Argentina; known only from the type-locality, which is plotted in Fig. 3.

Type.—Holotype, female, Argentina, Rio Negro Province, Bariloche, December 1926, F. and M. Edwards, in British Museum (Natural History), London.

Physohelea turgidipes (Ingram and Macfie), NEW COMBINATION
Fig. 2b–c

Neurohelea turgidipes Ingram and Macfie, 1931:214 (female; Chile); Wirth 1974:48 (in catalog of Neotropical Ceratopogonidae).

Diagnosis.—A species of *Physohelea* very similar to *P. oedidactyla* but differing from that species by its mostly yellowish legs with the distal ¼ of the femora and tibiae brown and with large yellowish anterolateral spots on the scutum.

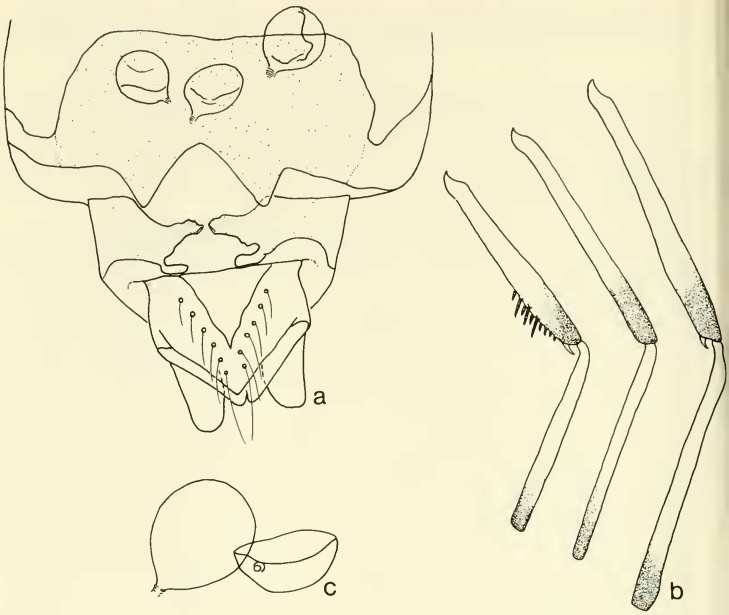

Fig. 2. *Physohelea oedidactyla* and *P. turgidipes*, females. a, genitalia of *P. oedidactyla;* b and c, leg patterns and spermathecae, respectively, of *P. turgidipes*.

Female.—For a complete description see Ingram and Macfie (1931). To that description may be added the following: Wing length 2.50–2.79 mm; breadth 0.86–0.90 mm. Antenna with lengths of flagellomeres in proportion of 19-13-13-14-14-15-17-17-26-27-26-26-26; antennal ratio 1.07–1.21. Palpus with lengths of segments in proportion of 6-9-13-7-15; palpal ratio 2.55–2.60. Legs (Fig. 2b) yellowish except brown on distal ¼ of femora and tibiae; front femur with 6–12 spines. Costa of wing extending to 0.89–0.91 of wing length. Two slightly larger spermathecae (Fig. 2c), the largest measuring 0.076 by 0.055 mm.

Male.—Unknown.

Distribution.—Southern Chile; locality records plotted in Fig. 3.

Type.—Holotype, female, Chile, Chiloe Province, Mechuque Island, 23 December 1926, F. and M. Edwards, in British Museum (Natural History), London.

Additional Material Examined.—CHILE: Chiloe Province, Isla Chiloe, Ancud, December 1926, R. and E. Shannon, 1 female, on slide, in USNM.

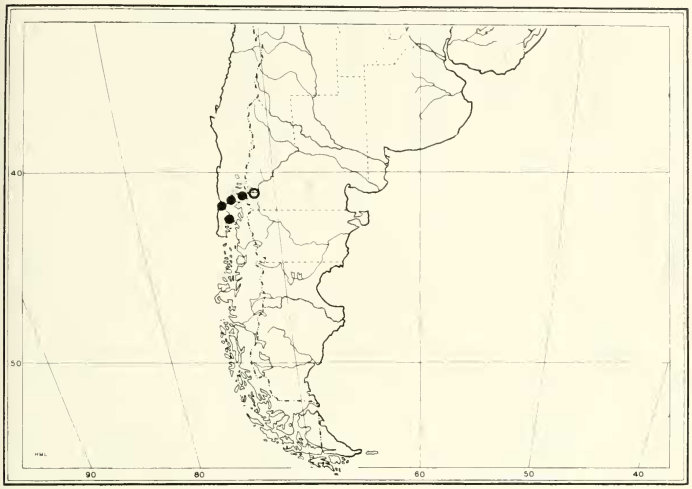

Fig. 3. Locality records of *Physohelea oedidactyla* (open circle) and *P. turgidipes* (closed circles) in southern Chile and Argentina.

Phylogenetic Relationships

Downes (1977) has presented the only phylogenetic diagram of the tribes of the Ceratopogoninae to date. His diagram is rather simplified and is based to a large extent on the feeding habits, but we agree with its general arrangement and branching sequence of the tribes. Within the Cerotopogoninae, Downes placed the Heteromyiini in that group in which the female captures and devours the male during the mating process. He also indicated from his diagram that the Heteromyiini arose from a Ceratopogonini-Stilobezziini ancestor. We believe that the Stilobezziini is probably the more logical ancestor of the Heteromyiini.

Figure 4 presents a proposed phylogeny for the genera in the tribe Heteromyiini. We believe that this tribe is a monophyletic group having in common apotypic character state 1, an inflated front fifth tarsomere. This character is better developed in some genera than in others; nevertheless, it along with some other apotypic characters indicates that the Heteromyiini are monophyletic in origin.

Branch A in Fig. 4 includes *Physohelea, Neurohelea* and *Neurobezzia,* and these three genera are thought to be the most plesiotypic in the tribe. They share apotypic character state 2, a barely sessile media, that is, forking

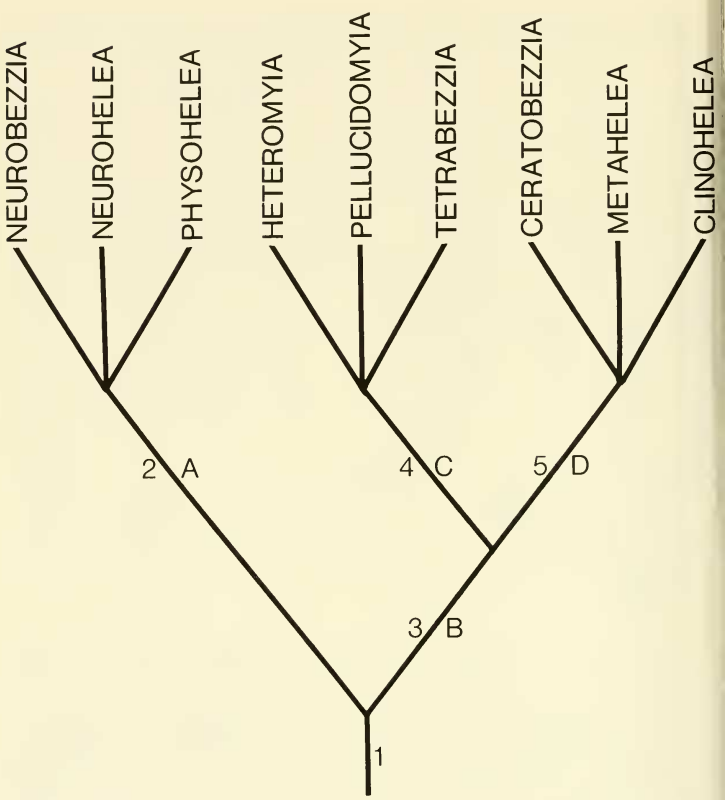

Fig. 4. Phylogeny of the genera in the tribe Heteromyiini. Apotypic character states are: 1, inflated 5th tarsomere of front leg; 2, media barely sessile, forking at level of r-m crossvein; 3, media broadly sessile, forking proximal to level of r-m crossvein; 4, greatly elongated hind 4th and 5th tarsomeres and claws; 5, bifid, spinose, hind 4th tarsomere.

at the level of the r-m crossvein, and are the only genera in the family that possess this character. This character probably represents an intermediate condition between the plesiotypic petiolate media of the Stilobezziini and the broadly sessile media (apotypic character state 3) present in the other six genera in the Heteromyiini (branch B), and the Sphaeromiini, Palpomyiini, and Stenoxenini. The genera in branch A also share several plesiotypic characters such as the cordiform fourth tarsomeres and equal-sized

claws usually with basal inner teeth. *Heteromyia* (branch C) is apparently the only other genus to have retained the plesiotypic condition of claws with basal inner teeth.

Branch B in Fig. 4 includes in the Heteromyiini those genera which share apotypic character state 3, a broadly sessile media. This character is also found in all of the higher ceratopogonid genera, as stated previously. The genera in branch B exhibit several unusual modifications such as bifid, spinose fourth tarsomeres and greatly elongated hind claws, characters unique to the Heteromyiini.

Branch C in Fig. 4 includes *Heteromyia*, *Pellucidomyia* and *Tetrabezzia*, all of which share apotypic character state 4, greatly elongated hind fourth and fifth tarsomeres and claws. These characters are unique to these three genera, which are apparently closely associated, and probably represent modifications for specialized feeding behavior. However, nothing is presently known of the feeding or mating habits of these genera.

Branch D in Fig. 4 includes *Ceratobezzia*, *Metahelea* and *Clinohelea*, all of which share apotypic character state 5, hind fourth tarsomere bifid and spinose. The fourth tarsomeres of the front and middle legs of *Clinohelea* and *Metahelea*, and the middle leg of *Ceratobezzia*, are bifid and spinose as well. These structures may be used for holding prey. *Tetrabezzia* (branch C) also has the fourth tarsomeres of the front and middle legs bifid and spinose. This may indicate that *Tetrabezzia* might have developed this character independently from those genera in branch D or that branches C and D are paraphyletic. At present we are uncertain as to what sort of hind fifth tarsomere the ancestor of branches C and D possessed. We may be better able to determine the relationships of these two groups if new characters are discovered or when we know more of their biologies.

Literature Cited

Downes, J. A. 1977. Evolution of feeding habits in Ceratopogonidae. Mosquito News 37:279–280.

Ingram, A. and J. W. S. Macfie. 1931. Ceratopogonidae. Diptera of Patagonia and South Chile, Part II, Fascicle 4, pp. 155–232.

Johannsen, O. A. 1943. A generic synopsis of the Ceratopogonidae (Heleidae) of the Americas, a bibliography, and a list of the North American species. Ann. Entomol. Soc. Am. 36:763–791.

Malloch, J. R. 1915. The Chironomidae or midges of Illinois. Bull. Ill. State Lab. Nat. Hist. 10:213–243.

Wirth, W. W. 1952. The Heleidae of California. Univ. Calif. Publ. Entomol. 9:95–266.

———. 1974. A catalogue of the Diptera of the Americas south of the United States. 14. Family Ceratopogonidae, pp. 1–89. Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil.

Wirth, W. W., N. C. Ratanaworabhan and F. S. Blanton. 1974. Synopsis of the genera of Ceratopogonidae (Diptera). Ann. Parasitol. Hum. Comp. 49:595–613.

Wirth, W. W., N. C. Ratanaworabhan and D. H. Messersmith. 1977. Natural history of Plummers Island, Maryland. XXII. Biting midges (Diptera: Ceratopogonidae). 1. Introduction and key to genera. Proc. Biol. Soc. Wash. 90:615–647.